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REVISED
PREDESIGN REPORT

BLACKWELL LANDFILL NPL SITE
DUPAGE COUNTY, ILLINOIS

Montgomery Watson File No. 1252008

Prepared For:

Forest Preserve District
DuPage County, Illinois

Prepared By:

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July 1997

MONTGOMERY WATSON

REVISED
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DUPAGE COUNTY, ILLINOIS

Prepared For:

Forest Preserve District
DuPage County, Illinois

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1.0 INTRODUCTION

This Predesign Report presents the results of the Predesign Investigation conducted at the Blackwell Landfill NPL site (landfill) in DuPage County, Illinois. The Predesign Investigation was conducted in accordance with the Design Work Plan (August 1996), which was approved by the U.S. EPA on August 23, 1996. The scope of the predesign investigation was outlined in the Statement of Work (SOW) (Appendix A to the Consent Order between the U.S. EPA and the DuPage County Forest Preserve District (FPD), U.S. EPA Docket No. V-W-'96-C-341, March 1, 1996), and included the following tasks:

- Limits of Fill Determination
- Cap Continuity/Characterization
- Arboreal Impact Investigation
- Monitoring Well Assessments
- Gas Vents Evaluation

The Predesign Investigation was conducted in two phases. The first phase of the investigation was conducted between October 7 and October 30, 1996, with results summarized in a January 1997 Technical Memorandum. The investigation results provided suitable information for future design submittals; however, some data gaps were found in the identification of the limits of fill and characterization of the landfill cap. The Memorandum proposed the scope of the second phase of the investigation, which was subsequently modified based upon March 4, 1997 comments from the U.S. EPA and IEPA. The second phase of the investigation was conducted between March 10 and March 12, 1997, and combined Phase I and II results are presented within this Predesign Report.

The Arboreal Impact Investigation has not been performed to date. It will be conducted in the summer of 1997.

This Report includes the following:

- A summary of field activities,
- Delineation of the extent of fill,
- Delineation of suitable cap material, and
- Recommendations for beginning the Groundwater Monitoring Plan and Arboreal Impact Investigation.

2.0 SUMMARY OF FIELD ACTIVITIES

ACTIVITY 1 - LIMITS OF FILL INVESTIGATION

The purpose of the Limits of Fill Investigation activity was to delineate the lateral limits of waste around approximately half of the landfill. The southwest and extreme east sides of the landfill were excluded from the investigations because the approximate limits of waste have been previously established at these locations. The investigation was accomplished by performing a limited geophysical survey to determine the general waste boundary, followed by a test boring program to confirm waste limits. The geophysical survey was performed from October 7 through October 9, 1996; while Phase I of the test boring program was performed from October 7 through October 15, 1996. Analysis of the Phase I soil borings indicated that the lateral limits of waste were not fully defined in some areas, and subsequently Phase II of the program was performed from March 10 through March 12, 1997 for the purpose of obtaining this missing information.

The results of the geophysical survey are presented in Appendix C. This information was immediately available in the field at the start of the drilling program, and was used to establish initial borehole locations at approximate 100-foot intervals around the landfill. Two to five borings were required at each boring interval to establish waste limits. Table 1 lists the test boring locations and identified waste elevations. Figure 1 provides the location of the test borings and the limits of waste. Appendix A contains the test boring logs for locations shown on Figure 1. The locations of each geophysical transect and Phase I boring were staked and surveyed by a licensed surveyor prior to the start of the investigation. Location coordinates were established to the local grid system, and grid elevations were referenced to Mean Sea Level (MSL). Phase II borings were either drilled adjacent to Phase I borings, or were offset from Phase I borings using tape and compass methods.

Soil cuttings generated during Phase I of the drilling program were compacted back into their respective borings. At least a one-foot thickness of bentonite was also compacted over waste, where encountered. During Phase II, encountered waste was compacted back into their respective borings, and the remaining borehole was backfilled with bentonite chips. The quantity of remaining soil cuttings was minimal, and the cuttings were therefore placed on top of the borehole.

The investigation has modified the previously mapped limits of waste in three specific areas of the landfill. For the purposes of this Report, we have generally defined the lateral limits of waste at each borehole transect as extending outward to the first boring that did not encounter waste. Occasionally when waste was not encountered at a boring transect, we have conservatively maintained the previous estimated edge of waste. The first modified area is located in the northern portion of the landfill near boring TB23, where a triangular area was not previously thought to contain waste. The investigation determined that this triangular area does contain waste, with waste material encountered at depths ranging from 6 to 12 feet, as identified in borings TB33, TB23, and TB35. The second

modified area is located between borings TB44 and TB58, where the new limits of waste have been moved 40 to 50 feet east (outward). Waste material was encountered at depths ranging from 5 to 7.5 feet, as identified in borings TB45, TB47, TB48, TB51, TB52, and TB55. The third modified area of waste is located between borings TB57 and TB74, where the limits of waste have been moved 25 to 50 feet inwards or outwards.

Slight modifications to the limits of waste were also made at other locations within the remainder of the investigation area. However, these changes did not exceed a shift more than 20 feet inward or outward from the previously mapped limits of waste.

ACTIVITY 2 - CAP CONTINUITY/CHARACTERIZATION INVESTIGATION

The objective of the Cap Continuity/Characterization Investigation was to identify areas of the landfill which do not contain a cover meeting the requirements of 35 IAC Part 807 (i.e., a minimum of two feet of suitable material). Shallow test borings were drilled into the landfill cap at selected locations with hollow-stem augers and cover thicknesses were measured. Selected soil samples were collected from these borings for analysis of grain size distribution and permeability. Phase I of the investigation was performed from October 7, 1996 through October 17, 1996; while Phase II was conducted from March 10 through March 12, 1997.

Test boring locations were based on a grid system with 200-foot centers. The grid system covered the entire area within the limits of waste, except for the southwest portion of the site, where it has been previously documented that the cover thickness greatly exceeded two feet. However, additional boreholes were drilled at 100-foot grid centers where the cap thickness at the 200-foot grid locations were less than two feet (e.g., around TB1 and TB3). The location of each boring was staked and surveyed by a licensed surveyor prior to drilling. Location coordinates were established to the local grid system, and grid elevations were referenced to Mean Sea Level (MSL). During Phase I, soil cuttings generated during the drilling program were compacted back into their respective borings. At least a one-foot thickness of bentonite was also compacted over waste, where encountered. During Phase II, encountered waste was compacted back into their respective borings, and the remaining borehole was backfilled with bentonite chips. The quantity of remaining soil cuttings was minimal, and the cuttings were therefore placed on top of the borehole.

The resultant landfill cover thickness data is summarized in Table 2 and Figure 2, with boring logs presented in Appendix B. Cover thickness data from nine extraction wells installed at the Blackwell Landfill during May and June 1996 are also summarized in Table 2, with locations presented on Figure 2.

Shelby tube samplers were used to collect suitable samples of undisturbed cap material for permeability testing. During Phase I, suitable samples could not be obtained at several borehole locations, even after numerous attempts, due to sampling difficulties (e.g., Shelby tube sampler striking stones). Furthermore, during Phase I, some collected samples were visually inspected and determined by the testing laboratory to be unsuitable for

permeability testing due to excessive sample disturbance, or the inability to saturate the sample. During Phase II, additional shallow soil borings were drilled adjacent to the unsuccessful Phase I borings, and additional Shelby tube samples were collected. While some of the Phase II samples were also damaged, except for one location, we were able to obtain at least one undamaged Shelby tube sample per boring location.

The only location where we were unable to collect an undamaged Shelby tube sample was at borehole location TB3B. Subsequently, we excavated Test Pit TP01 at this location to collect a suitable block sample. We found that the encountered soil generally consisted of sand with gravel and cobbles, and pockets of silty clay with gravel and cobbles. We considered the soil cover at this location unsuitable as landfill cap material, and discontinued further sampling efforts. The test pit was backfilled to ground surface with excavated material. The test pit log is provided in Appendix B.

The boring information indicates that the majority of the landfill cover meets, or exceeds, the minimum two-foot thickness requirement of 35 IAC Part 807. The areas of landfill cover which do not meet the two-foot requirements are shown in Figure 3. For the purposes of this report, the approximate edge of the unsuitable areas have been defined as the mid-point between applicable borehole locations, adjusted for topography and location. The exact edge of the unsuitable areas will be defined during remedial construction.

The grain size distribution and permeability test results are summarized in Tables 3 and 4, and the laboratory data sheets are compiled in Appendix D. Permeability results are also summarized in Figure 2. These data indicate that the landfill cap is comprised of silty clay (Unified Soil Classification System (USCS) classification CL) with some clayey silt (USCS classification ML), and that the hydraulic conductivity of the sampled cap material range from 8.1×10^{-7} to 2.2×10^{-8} cm/sec. These materials are considered suitable as landfill cover material.

ACTIVITY 3 - ARBOREAL IMPACT ASSESSMENTS

The Arboreal Impact Assessment is intended to determine the distribution and depth of existing tree and woody vegetation root systems on the landfill. However, this assessment has not been performed to date due to scheduling difficulties late in the fall, and we have rescheduled it to start during the summer of 1997.

ACTIVITY 4 - MONITORING WELL ASSESSMENTS

The objective of the Monitoring Well Assessment activity was to confirm the integrity of existing monitoring wells, and to aid in the identification of unnecessary monitoring wells and piezometers. The integrity survey was intended to be completed on monitoring wells numbered G100 through G120, inclusive, and those wells proposed for inclusion in the quarterly groundwater monitoring program. As well, it was intended that each well be redeveloped. However, due to the extraneous nature of some development data (i.e., some

wells will be proposed for abandonment) and the excessive amounts of water which would have been generated (i.e., most of the wells had four-inch diameter casings), the FPD elected to undertake redevelopment only on those wells initially proposed for inclusion in the quarterly groundwater monitoring program. If required, additional monitoring wells may be redeveloped, if they are added to any future detection or compliance groundwater monitoring program.

The integrity survey was conducted from October 23 through October 29, 1996, and included inspections to determine if wells were structurally sound, had adequate protection and were capable of providing representative groundwater quality data. Photographs were taken at each well location, and weep holes were drilled in the well casing, if adequate drainage did not exist. The results of the survey are summarized in Tables 5 and 6, with well development summaries provided in Appendix E. Photographs are filed in Montgomery Watson's project files.

The well integrity survey indicated that the majority of the monitoring wells were structurally intact and secure. The exceptions are noted below:

- Two monitoring wells (G104 and G106) appear to have filter pack sand in the bottom of the wells, indicating possible damage to the well screen or well pipe joint.

- Eight monitoring wells (G100A, G100B, G106, G108, G114A, G119, G121 and G136) have missing or damaged locks, or damaged protective casings with rusted-off or broken lid hinges.

- One monitoring well (G114A) has a cracked and heaved surface seal.

The redevelopment efforts on those wells initially proposed for inclusion in the quarterly groundwater program were generally successful, with indicator parameters stabilizing during redevelopment. Purge water was contained on-site and was later disposed of by the FPD under their leachate disposal permit. However, monitoring well G136 was purged dry after removing approximately one and a half well volumes, with recharge measured at one-foot recovery in three minutes.

The groundwater monitoring network at the landfill was reviewed to identify monitoring wells and piezometers which could be abandoned or retired from future use. Rational for possible abandonment or retirement included: 1) damaged or missing locks, damaged protective casings with rusted-off or broken lid hinges, or insecure surface seals, any of which would require major effort to maintain integrity; 2) screened intervals located within a till aquitard instead of a groundwater aquifer; and 3) wells that are duplicates of nearby wells. A list of the identified wells and piezometers is provided below:

Wells and Piezometers Proposed For Abandonment or Retirement	
Shallow Wells/Piezometers	
P1	Screened within till aquitard outside the edge of the shallow aquifer.
P4	Screened within till aquitard outside the edge of the shallow aquifer.
G100	Screened within till aquitard outside the edge of the shallow aquifer.
G100AB	Missing lock. Duplicate of G100.
G101	Screened within till aquitard outside the edge of the shallow aquifer.
G102	Screened within till aquitard outside the edge of the shallow aquifer.
G103S	Screened within till aquitard outside the edge of the shallow aquifer.
G104	Possible damaged well screen. Screened within till aquitard outside the edge of the shallow aquifer.
G105	Screened within till aquitard outside the edge of the shallow aquifer.
G105ABC	One-inch diameter piezometers located in a single borehole. Replaced by G105.
G106	Screened within till aquitard outside the edge of the shallow aquifer. Possible damaged well screen. Missing lock.
G108	Duplicate of G107S and G121. Damaged lock.
G109	Duplicate of G107S and G126.
G110	Duplicate of G126 and G127.
G111	Duplicate of G117 and G127.
G112	Duplicate of G114 and G117.
G113	Duplicate of G114.
G114A	Missing lock. Cracked seal.
G115S	Duplicate of G129.
G116	Water level is not representative of groundwater flow conditions.
G118D	Screened within till aquitard.
G119	Screened within till aquitard outside the edge of the shallow aquifer. Damaged lock.
G124	Screened within till aquitard outside the edge of the shallow aquifer.
G125	Screened within till aquitard outside the edge of the shallow aquifer.
G128S	Duplicate of G117 and G123.
G128I	Duplicate of G128S.
G140S	Duplicate of G127.

Wells and Piezometers Proposed For Abandonment or Retirement	
Deep Wells/Piezometers	
G103D	Screened within till aquitard.
G107D	Screened within till aquitard.
G115D	Screened within till aquitard.
G120S	Screened within till aquitard.
G120D	Screened within till aquitard.
G131DD	Duplicate of G131D.
G132DD	Duplicate of G132D.
G133DD	Duplicate of G133D.
G136	Water level not representative of groundwater conditions. Well was pumped dry during redevelopment activities indicating that the well is apparently screened in crystalline rock with limited fractures. Rusted-off lid on protective casing.

The remaining wells in the groundwater monitoring network were also reviewed to identify existing wells which should be included in the future quarterly groundwater monitoring program as detection monitoring wells, compliance monitoring wells, and water level wells, and additional monitoring well requirements. The resulting proposed monitoring program is summarized below.

Groundwater Monitoring Network

Detection Monitoring Wells

Glacial Outwash Aquifer Wells	Bedrock Wells
G107S	G128D
G117	G135
G118S	G140D
G123	G141D
G126	**G145** (new well)
G127	
G129	
G130S	

Compliance Monitoring Wells

Glacial Outwash Aquifer Wells	Bedrock Wells
G122	G131D
G133S	G133D
G142 (new well)	G138
G143 (new well)	G139
G144 (new well)	**G146** (new well)

Water Level Wells

Glacial Outwash Aquifer Wells	Bedrock Wells
P2	G132D
G114	G134
G121	G137

Five new monitoring wells will be installed on the west side of the landfill. These supplemental well installations will comprise three shallow monitoring wells (approximately 20 feet deep) and two deep monitoring wells (approximately 60 feet deep).

The three new shallow monitoring wells will be installed adjacent to existing deep well G138, new deep well G146, and existing deep well G139 to form well pairs (see Figures F1 and F2, Appendix F), and will be designated as G142 through G144, respectively, to continue the existing numbering system at the landfill. These shallow wells will serve as downgradient compliance wells during the quarterly groundwater monitoring program, and with other exiting wells will provide sufficient representation of the upper outwash aquifer.

The two new deep monitoring wells will be installed in the interval between G128D and G135, and adjacent to new shallow well G143, respectively (see Figures F1 and F2, Appendix F). The new deep well between G128D and G135 will become a deep detection monitoring well designated as G145, while the new deep well adjacent to G143 will provide compliance coverage of the lower aquifer and will be designated G146. All monitoring wells will be installed and developed in accordance with the August 1996 Design Work Plan and Field Sampling Plan for the Predesign Investigation Activities (Vol. III of IV).

Monitoring wells G121 and G136 were initially proposed as detection or compliance wells for the quarterly groundwater monitoring program. However, the well integrity survey identified that both these wells may have lost integrity due to broken or rusted-off protective casing lids. In addition, a comparison of data indicated that water levels in well G136 were not representative of groundwater conditions, and the field investigation showed that the well could be pumped dry during development. This suggests that G136 may be screened in crystalline rock with limited fractures. Therefore, wells G107S and G135 are proposed as alternative detection or compliance wells and well G121 is proposed as a water level only well.

The well integrity survey and/or well redevelopment has not been performed on seven existing monitoring wells proposed for inclusion in the quarterly groundwater monitoring program. These are: P2, G132D, G134, and G137 proposed for water levels; G130S and G135 proposed as detection monitoring wells; and G131D proposed as a compliance monitoring well. In addition, during previous well re-development efforts, high and potentially inaccurate pH values were measured at well G121, and pH and specific conductivity could not be measured at G127 due to equipment malfunctions. Therefore, we will perform a well integrity survey at the seven wells, P2, G130S, G131D, G132D, G134,

G135, and G137, and redevelop seven wells for measurement of indicator parameters: G107S, G118S, G121, G127, G130S, G131D and G135.

The well integrity survey will be used to assess the condition of each of these existing wells, and determine whether each well is suitable as a monitoring point. The integrity survey will be conducted prior to starting the first round of the quarterly monitoring program, and will be conducted in accordance with the methods specified in the Field Sampling Plan for Predesign Investigation Activities (Volume III). The survey will include inspections to determine if the wells are structurally sound, provide adequate protection, and are capable of providing representative groundwater quality data, as appropriate. The results of the integrity survey will be summarized in a monitoring well assessment report. If the existing monitoring wells are found to be unsuitable for groundwater sampling, then additional monitoring wells will be proposed or new monitoring wells will be installed. Details of the program are outlined in Appendix F.

ACTIVITY 5 - GAS VENT EVALUATION

The objective of the landfill gas vent evaluation was to evaluate the condition of 30 existing landfill gas vents, and to measure gas quality, if possible. The evaluation consisted of measuring vent depths, leachate head levels and landfill gas composition, and observing the condition of the surface vent/riser. The evaluation was performed on October 21 and 22, 1996.

Gas measurements and monitoring data obtained during the gas vent evaluation are presented in Table 7, while leachate head elevation data for 1996 are presented in Table 8. These tables indicate that liquid depths measured in the vents ranged from 6.52 to 72.80 feet below the top of the vent casing pipe. These values may represent either actual leachate head levels or perched liquids. Landfill gas composition readings were measured at each vent's discharge with a portable gas monitoring instrument. Methane was detected at all but four of the gas vents at concentrations ranging from 1.0% to 73.5%, by volume. Carbon dioxide levels ranged from zero to 43.0%, by volume, while oxygen concentrations ranged from zero to 20.2%, by volume. Gas pressures ranged from non-measurable to 2.1 inches of mercury. The evaluation also noted that gas vent DV-7 was obstructed at a depth of 87 feet.

The future of the existing gas vents will be discussed, in greater detail, as part of the future O&M plan for the leachate collection system (LCS). The draft O&M Plan is scheduled to be prepared during the construction of the LCS.

3.0 IMPACTS OF REMEDIAL ACTIVITIES

The proposed remedial action for the Blackwell Landfill Site includes repair of the existing landfill cover, installation of a leachate collection system, passive landfill gas venting, and implementation of a monitoring program. These remedial actions are anticipated to have the following impacts on the Site:

Repair of Landfill Cover. The cover repairs will minimize storm water infiltration, and thereby reduce the generation of landfill leachate. The cap repairs will also reduce landfill gas emissions through the cover.

Leachate Collection System. The leachate collection system will remove landfill leachate, and may lower leachate levels in the municipal waste. This may result in an incremental decrease in leachate leakage as the hydraulic gradient is decreased.

Passive Gas Ventilation. The gas ventilation system will reduce gas pressure in the landfill, thereby reducing gas migration, gas emissions, and odors.

Arboreal Impact Evaluation. The arboreal impact evaluation will identify suitable and appropriate species of trees that can safely exist on the landfill.

4.0 SUMMARY AND RECOMMENDATIONS

The predesign investigation activities completed to date have collected suitable information for future design submittals. The following activities will be performed during the summer of 1997 pending approval by U.S. EPA:

- Perform the well integrity survey on seven additional monitoring wells and piezometers;
- Redevelop seven wells;
- Install five new monitoring wells;
- Reschedule the Arboreal Impact Assessment; and
- Initiate the quarterly monitoring program.

From our review of the existing groundwater monitoring network, we identified a number of wells and piezometers that will not provide meaningful long-term data or provide data that is also provided by another monitoring point. Therefore, we recommend abandoning or retiring 36 existing wells and piezometers.

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APPENDIX F
PROPOSED GROUNDWATER MONITORING PLAN

QUARTERLY GROUNDWATER MONITORING

The objective of this activity is to detect changes in the chemical concentration of the groundwater in both the glacial aquifer and in the underlying bedrock aquifer in downgradient areas between the landfill and the Blackwell Forest Preserve's boundary during the period between remedial design and Record of Decision. Instructions for the collection of samples are located in Appendix A of the Field Sampling Plan for Pre-Design Investigation Activities, August 1996 (Vol. III of IV), and the attached Addendum (Groundwater Sampling and Testing SOP).

Description of Response Action
The groundwater monitoring program for the site will consist of the following tasks:

Task	Schedule for Implementation
1. Installation of Monitoring Wells	Upon approval of this Proposed Monitoring Plan
2. Implement quarterly monitoring	Upon approval of this Proposed Monitoring Plan
3. Recommend modifications to the monitoring program	Upon evaluation of quarterly data
4. Implement O & M monitoring program	Upon receipt of the Record of Decision and Consent Decree or Unilateral Administrative Order

The tasks incorporate the requirements of the U.S. EPA's Scope of Work. The following sections provide the design and implementation plans for the quarterly monitoring program required in the U.S. EPA's Scope of Work. Upon approval of this Proposed Monitoring Plan, the quarterly monitoring program will be implemented. Changes to the monitoring program may be recommended following evaluation of the quarterly data and any changes would be implemented as part of the long term O&M and monitoring program.

Purpose
The monitoring program will include field and laboratory testing of samples. Analytical results will be used to:

- Provide on-going characterization of groundwater quality downgradient of the site.
- Provide baseline groundwater data during the cap repair remediation, which may be utilized to estimate the length of time until groundwater standards are met through natural attenuation.

- Determine whether the reduction of contaminant loading from the cap repairs, in combination with natural attenuation and dilution, will allow for the standards of 35 IAC 620.410 to be achieved over time.

- To confirm that concentrations of groundwater contaminants do not exceed any MCL, an excess cancer risk greater than 10^{-6}, or Hazard Index greater than or equal to 1.0, whichever is more stringent, at the Blackwell Forest Preserve's downgradient boundary.

Five monitoring wells will be installed on the west side of the Blackwell Landfill.

Wells to be Installed	Aquifer	Well Service Designation
G142	Outwash Glacial	Compliance
G143	Outwash Glacial	Compliance
G144	Outwash Glacial	Compliance
G145	Bedrock	Detection
G146	Bedrock	Compliance

These monitoring well installations will supplement the sampling of the glacial aquifer and the underlying bedrock during quarterly groundwater monitoring program.

Monitoring Program

New and existing monitoring wells have been selected for the groundwater monitoring program for the site. The wells are divided into: 1) detection monitoring wells located between the landfill and the Blackwell Forest Preserve's boundary; 2) compliance monitoring wells located along the downgradient boundary of the Preserve, and 3) other monitoring wells or piezometers for water level measurements only. The monitoring program is further divided into wells which monitor the glacial outwash aquifer (Figure F1) and those which monitor the underlying bedrock aquifer (Figure F2). The definition of detection and compliance monitoring, and the rationale for the choice of monitoring wells, is described below:

Detection Monitoring Wells

Glacial Outwash Aquifer Wells	Bedrock Wells
G107S	G128D
G117	G135
G118S	G140D
G123	G141D
G126	**G145***
G127	
G129	
G130S	

Compliance Monitoring Wells

Glacial Outwash Aquifer Wells	Bedrock Wells
G122	G131D G133S G133D
G142*	G138
G143*	G139
G144*	**G146***

Water Level Wells

Glacial Outwash Aquifer Wells	Bedrock Wells
P2	G132
G114	G134
G121	G137

Note:
* Monitoring wells to be installed and added to the quarterly groundwater monitoring plan.

The detection monitoring wells listed above were chosen to monitor downgradient groundwater quality concentrations between the landfill waste boundary and the FPD property boundary. These wells were chosen as detection monitoring wells, because they are in the correct locations, downgradient of the landfill, to assess any changes in groundwater quality relative to existing concentrations.

The compliance monitoring wells were chosen, because they are located closest to the FPD property boundary, downgradient of the landfill. These wells will be used to confirm that concentrations of groundwater contaminants in these boundary wells do not exceed any MCL, cancer risk greater than 10^{-6}, or Hazard Index greater than or equal to 1.0, whichever is more stringent.

The water level monitoring wells were chosen to provide additional water level data from that collected from the detection and compliance monitoring wells. As a network, these wells can be used to establish groundwater flow direction and velocity at the time of quarterly monitoring.

It is anticipated that one or more upgradient wells may be added to the monitoring program following assessment of the first round of quarterly monitoring.

Quality Control Sampling

Quality control samples will be collected, and will consist of sample duplicates, field blanks, and matrix spike/matrix spike duplicates (MS/MSD) samples, as described below.

Field Blanks (FB)
A laboratory prepared sample of reagent grade water will be routed through decontaminated sampling equipment to assess the effectiveness of decontamination procedures.

For Level IV water samples, one field blank will be prepared for each container type and size. Field blanks will be prepared according to the following schedule for each sampling activity:

- One field blank for every 10 or fewer samples of water collected; and
- For each sample period, a minimum of one blank for each group of parameters per sample matrix.

The field blank samples will be prepared using deionized water stored in polyethylene containers. For monitoring well samples, the water will be routed through the previously decontaminated sampling device before transfer to the container.

Trip Blanks (TB)
A water sample, prepared by the laboratory, will be transported to the site. The sample will remain unopened and be returned to the laboratory for analysis to evaluate QA/QC of sample handling procedures.

A trip blank for VOC analyses will be included in each sample cooler containing water matrix samples intended for VOC analysis. The trip blanks will consist of two 40-ml VOA vials filled with deionized water with a Milli-Q cleanup. It will be prepared in the office or laboratory, transported to the field and shipped with the other samples to the designated laboratory without being opened. It will be packaged using standard procedures as for other sample bottles.

Matrix Spike and Matrix Spike Duplicates (MS/MSD)
An additional sample volume collected in the field and sent to the laboratory for analysis. The results are used to evaluate the effect of the sample matrix on the digestion and measurement methodology. For water samples, one sample per group of 20 or fewer samples collected for VOC and SVOC analysis during each sampling activity will be selected for matrix spike/matrix spike duplicate (MS/MSD) analysis. For SVOCs, double the normal sample volume will be collected (i.e., four one-liter bottles). For VOCs, triple the normal sample volume will be collected (i.e., six, 40 ml vials).

Sample Duplicates
A duplicate sample taken in the field and analyzed in the laboratory to evaluate the homogeneity of the sample medium and the precision of the laboratory. One duplicate sample will be collected for each increment of 10 or fewer samples collected for each matrix during each sampling period. A duplicate sample will consist of a sample obtained from the same sampling device as the original sample.

A summary of the investigative and QA/QC samples is presented in Table 1-1. of the QAPP for Pre-design Investigation Activities (Vol. IV or IV) (August 1996). The supplier of the contaminant free sample containers will be the I-Chem Company or equivalent. The containers will be CLP Level 300 series bottles or equivalent.

Sampling Method

Low flow sampling procedures will be used to obtain all groundwater samples. This sampling technique is described in the attached SOP (Addendum to the QAPP for the Pre-Design Investigation Activities, August 1996).

Groundwater Sampling Frequency

The groundwater monitoring program will consist of performance of field and laboratory testing of the samples collected from each of the wells listed above. The monitoring program will begin following approval of this monitoring program. Sampling will be performed on a quarterly basis. Additional parameters will be included on an annual frequency. Table 1-1 of the QAPP for Pre-Design Investigation Activities (August 1996) (Volume IV) provides a listing of the parameters and frequency of sampling.

The U.S. EPA SOW indicates that if quarterly groundwater monitoring over a period of eight quarters indicates that contaminant concentrations throughout the system of groundwater monitoring wells are not increasing, the FPD may petition the U.S. EPA to allow monitoring on a less frequent basis. The U.S. EPA Statement of Work also states that if additional information indicates that the groundwater monitoring program is inadequate, the U.S. EPA may require that additional groundwater monitoring wells be added to the program.

Sample Analysis

Groundwater samples collected will be analyzed in the field and the analytical laboratory, as appropriate, for the parameters specified in Table 1-1 of the QAPP for Pre-Design Investigation Activities (August 1996). Groundwater samples will be analyzed for volatile organic compounds on the Target Compound list (TCL), semi-volatile organic compounds on the TCL, and the full Target Analyte List (TAL) of metals. Indicator parameters include chloride, sulfate, and TDS. Field parameters to be measured and recorded for each monitoring well are groundwater elevation, pH, temperature, turbidity, specific conductance, redox potential, and dissolved oxygen.

Analyses will be in compliance with, and meet the reporting limits required by, the State of Illinois' Groundwater Quality Standards at 35 IAC 620, and any Maximum Contaminant Level (MCL) designated at 40 CFR Part.

If additional information indicates that the groundwater monitoring program is inadequate, the U.S. EPA may require additional field or laboratory analysis of additional parameters.

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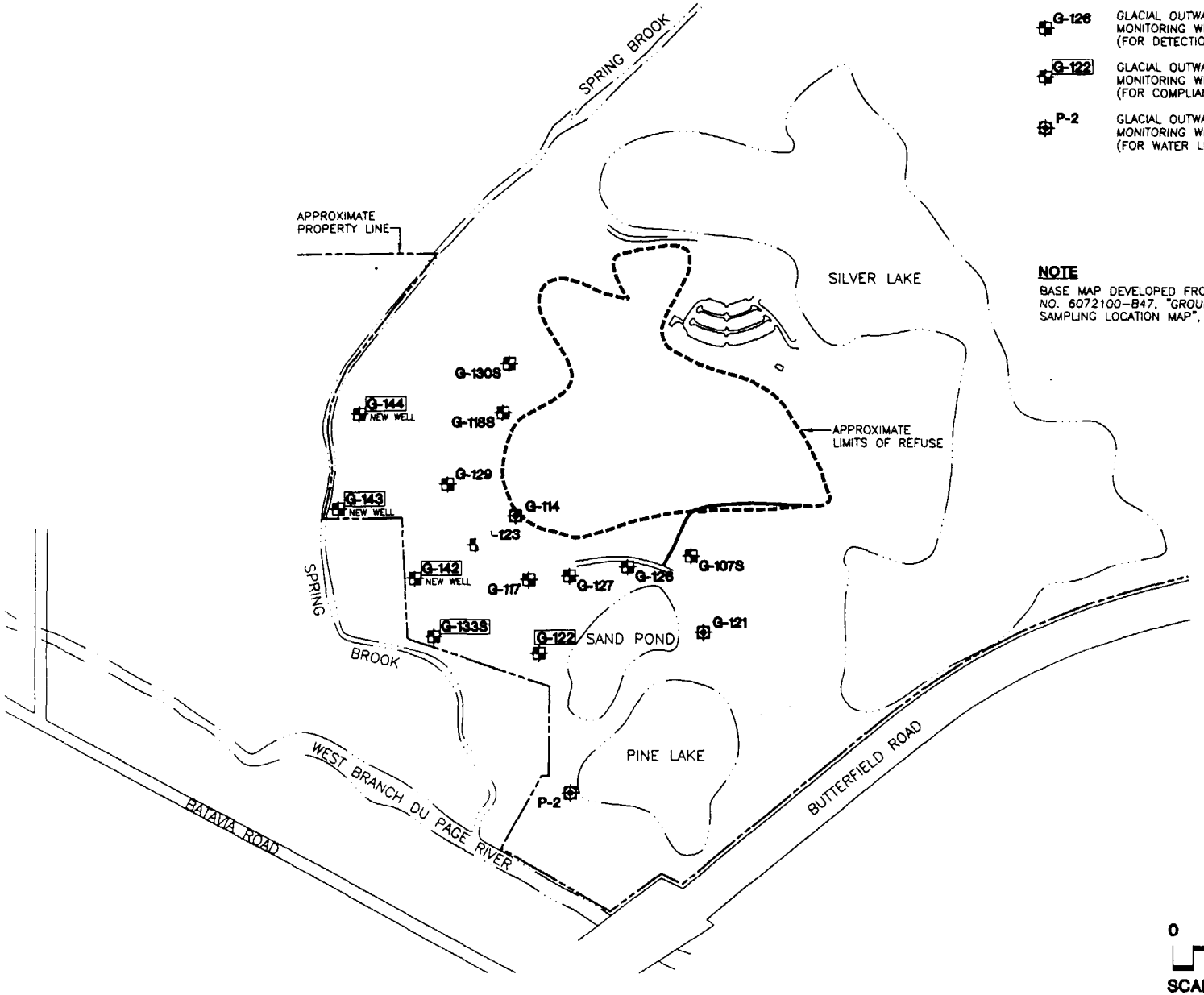


LEGEND

- G-126 — GLACIAL OUTWASH AQUIFER GROUNDWATER MONITORING WELL LOCATION AND NUMBER (FOR DETECTION MONITORING)
- G-122 — GLACIAL OUTWASH AQUIFER GROUNDWATER MONITORING WELL LOCATION AND NUMBER (FOR COMPLIANCE MONITORING)
- P-2 — GLACIAL OUTWASH AQUIFER GROUNDWATER MONITORING WELL LOCATION AND NUMBER (FOR WATER LEVELS)

NOTE

BASE MAP DEVELOPED FROM WARZYN INC. DRAWING NO. 6072100-B47, "GROUNDWATER MONITORING WELL SAMPLING LOCATION MAP", DATED JULY 28, 1994.

north

0 500 1000

SCALE IN FEET

FIGURE 1

GLACIAL OUTWASH AQUIFER GROUNDWATER MONITORING WELL SAMPLING LOCATION MAP

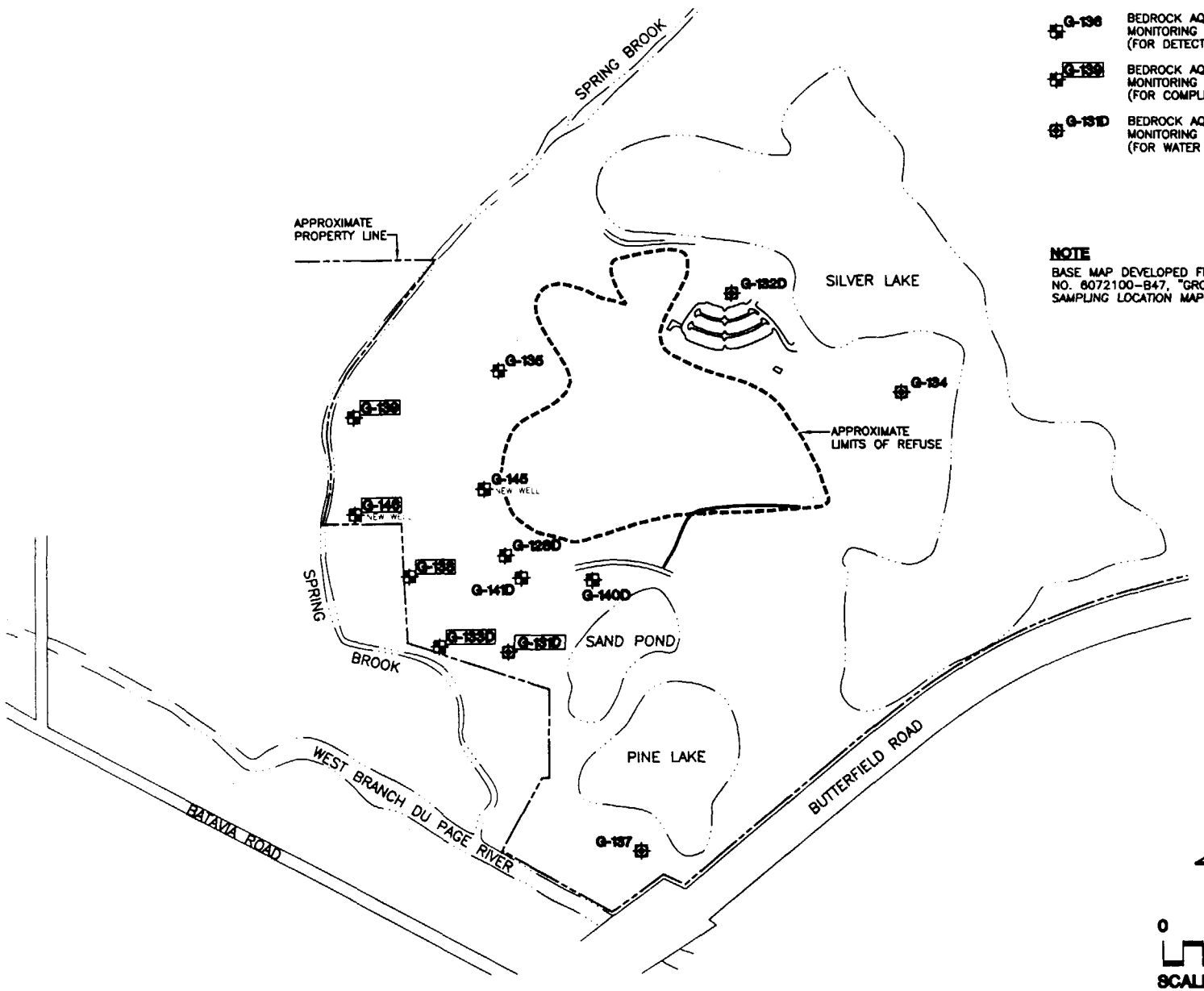
BLACKWELL LANDFILL SITE
DU PAGE COUNTY, ILLINOIS

Developed By TJK/BPG Drawn By LCL
Approved By Date
Reference 3920.0056-B1
Revisions

Drawing Number
1252008
050101 B1

MONTGOMERY WATSON

QUALITY CONTROL: Graphic Standards / Lead Professional; Technical Review / Project Manager; Management Review / Other



LEGEND

- G-136 — BEDROCK AQUIFER GROUNDWATER MONITORING WELL LOCATION AND NUMBER (FOR DETECTION MONITORING)
- G-139 — BEDROCK AQUIFER GROUNDWATER MONITORING WELL LOCATION AND NUMBER (FOR COMPLIANCE MONITORING)
- G-131D — BEDROCK AQUIFER GROUNDWATER MONITORING WELL LOCATION AND NUMBER (FOR WATER LEVELS)

NOTE

BASE MAP DEVELOPED FROM WARZYN INC. DRAWING NO. 6072100-B47, "GROUNDWATER MONITORING WELL SAMPLING LOCATION MAP", DATED JULY 28, 1994.

north

0 500 1000

SCALE IN FEET

FIGURE 2

QUALITY CONTROL | Graphic Standards | Land Professional | Technical Review | Project Manager | Management Review | Other

Developed By TJK/BPC Drawn By LCL

Approved By Date

Reference 3920.0056-B2

Revisions

BEDROCK AQUIFER GROUNDWATER MONITORING WELL SAMPLING LOCATION MAP

BLACKWELL LANDFILL SITE
DU PAGE COUNTY, ILLINOIS

Drawing Number
1252008
050101 B2

MONTGOMERY WATSON

1.0 INTRODUCTION

This Predesign Report presents the results of the Predesign Investigation conducted at the Blackwell Landfill NPL site (landfill) in DuPage County, Illinois. The Predesign Investigation was conducted in accordance with the Design Work Plan (August 1996), which was approved by the U.S. EPA on August 23, 1996. The scope of the predesign investigation was outlined in the Statement of Work (SOW) (Appendix A to the Consent Order between the U.S. EPA and the DuPage County Forest Preserve District (FPD), U.S. EPA Docket No. V-W-'96-C-341, March 1, 1996), and included the following tasks:

- Limits of Fill Determination
- Cap Continuity/Characterization
- Arboreal Impact Investigation
- Monitoring Well Assessments
- Gas Vents Evaluation

The Predesign Investigation was conducted in two phases. The first phase of the investigation was conducted between October 7 and October 30, 1996, with results summarized in a January 1997 Technical Memorandum. The investigation results provided suitable information for future design submittals, however, some data gaps were found in the identification of the limits of fill and characterization of the landfill cap. The Memorandum proposed the scope of the second phase of the investigation, which was subsequently modified based upon March 4, 1997 comments from the U.S. EPA and IEPA. The second phase of the investigation was conducted between March 10 and March 12, 1997, and combined Phase I and II results are presented within this Predesign Report.

The Arboreal Impact Investigation has not been performed to date. It will be conducted in the ~~spring and~~ summer of 1997.

This Report includes the following:

- A summary of field activities,
- Delineation of the extent of fill,
- Delineation of suitable cap material, and
- Recommendations for beginning the Groundwater Monitoring Plan and Arboreal Impact Investigation.

2.0 SUMMARY OF FIELD ACTIVITIES

ACTIVITY 1 - LIMITS OF FILL INVESTIGATION

The purpose of the Limits of Fill Investigation Activity was to delineate the lateral limits of waste around approximately half of the landfill. The southwest and extreme east sides of the landfill were excluded from the investigations because the approximate limits of waste have been previously established at these locations. The investigation was accomplished by performing a limited geophysical survey to determine the general waste boundary, followed by a test boring program to confirm waste limits. The geophysical survey was performed from October 7 through October 9, 1996, while Phase I of the test boring program was performed from October 7 through October 15, 1996. Analysis of the Phase I soil borings indicated that the lateral limits of waste were not fully defined in some areas, and subsequently Phase II of the program was performed from March 10 through March 12, 1997 for the purpose of obtaining this missing information.

The results of the geophysical survey are presented in Appendix C. This information was immediately available in the field at the start of the drilling program, and was used to establish initial borehole locations at approximate 100-foot intervals around the landfill. Two to five borings were required at each boring interval to establish waste limits. Table 1 lists the test boring locations and identified waste elevations. Figure 1 provides the location of the test borings and the limits of waste. Appendix A contains the test boring logs for locations shown on Figure 1. The locations of each geophysical transect and Phase I boring were staked and surveyed by a licensed surveyor prior to the start of the investigation. Location coordinates were established to the local grid system, and grid elevations were referenced to Mean Sea Level (MSL). Phase II borings were either drilled adjacent to Phase I borings, or were offset from Phase I borings using tape and compass methods.

Soil cuttings generated during Phase I of the drilling program were compacted back into their respective borings. At least a one-foot thickness of bentonite was also compacted over waste, where encountered. During Phase II, encountered waste was compacted back into their respective borings, and the remaining borehole was backfilled with bentonite chips. The quantity of remaining soil cuttings was minimal, and the cuttings were therefore placed on top of the borehole.

The investigation has modified the previously mapped limits of waste in three specific areas of the landfill. For the purposes of this Report, we have generally defined the lateral limits of waste at each borehole transect as extending outward to the first boring that did not encounter waste. Occasionally when waste was not encountered at a boring transect, we have conservatively maintained the previous estimated edge of waste. The first modified area is located in the northern portion of the landfill near boring TB23 where a triangular area was not previously thought to contain waste. The investigation determined that this triangular area does contain waste, with waste material encountered at depths

ranging from 6 to 12 feet, as identified in borings TB33, TB23, and TB35. The second modified area is located between borings TB44 and TB58 where the new limits of waste have been moved 40 to 50 feet east (outward). Waste material was encountered at depths ranging from 5 to 7.5 feet, as identified in borings TB45, TB47, TB48, TB51, TB52, and TB55. The third modified area of waste is located between borings TB57 and TB74 where the limits of waste have been moved 25 to 50 feet inwards or outwards.

Slight modifications to the limits of waste were also made at other locations within the remainder of the investigation area. However, these changes did not exceed a shift more than 20 feet inward or outward from the previously mapped limits of waste.

ACTIVITY 2 - CAP CONTINUITY/CHARACTERIZATION INVESTIGATION

The objective of the Cap Continuity/Characterization Investigation was to identify areas of the landfill which do not contain a cover meeting the requirements of 35 IAC Part 807 (i.e., a minimum of 2 feet of suitable material). Shallow test borings were drilled into the landfill cap at selected locations with hollow-stem augers and cover thicknesses were measured. Selected soil samples were collected from these borings for analysis of grain size distribution and permeability. Phase I of the investigation was performed from October 7, 1996 through October 17, 1996, while Phase II was conducted from March 10 through March 12, 1997.

Test boring locations were based on a grid system with 200-foot centers. The grid system covered the entire area within the limits of waste, except for the southwest portion of the site where it has been previously documented that the cover thickness greatly exceeded 2 feet. However, additional boreholes were drilled at 100-foot grid centers where the cap thickness at the 200 foot grid locations were less than 2 feet (e.g., around TB1 and TB3). The location of each boring was staked and surveyed by a licensed surveyor prior to drilling. Location coordinates were established to the local grid system, and grid elevations were referenced to Mean Sea Level (MSL). During Phase I, soil cuttings generated during the drilling program were compacted back into their respective borings. At least a one foot thickness of bentonite was also compacted over waste, where encountered. During Phase II, encountered waste was compacted back into their respective borings, and the remaining borehole was backfilled with bentonite chips. The quantity of remaining soil cuttings was minimal, and the cuttings were therefore placed on top of the borehole.

The resultant landfill cover thickness data is summarized in Table 2 and Figure 2, with boring logs presented in Appendix B. Cover thickness data from 9 extraction wells installed at the Blackwell Landfill during May and June 1996 are also summarized in Table 2, with locations presented on Figure 2.

Shelby tube samplers were used to collect suitable samples of undisturbed cap material for permeability testing. During Phase I, suitable samples could not be obtained at several borehole locations, even after numerous attempts, due to sampling difficulties (e.g., Shelby

tube sampler striking stones). Furthermore, during Phase I, some collected samples were visually inspected and determined by the testing laboratory to be unsuitable for permeability testing due to excessive sample disturbance, or the inability to saturate the sample. During Phase II, additional shallow soil borings were drilled adjacent to the unsuccessful Phase I borings, and additional Shelby tube samples were collected. While some of the Phase II samples were also damaged, except for one location we were able to obtain at least one undamaged Shelby tube sample per boring location.

The only location where we were unable to collect an undamaged Shelby tube sample was at borehole location TB3B. Subsequently, we excavated Test Pit TP01 at this location to collect a suitable block sample. We found that the encountered soil generally consisted of sand with gravel and cobbles, and pockets of silty clay with gravel and cobbles. We considered the soil cover at this location unsuitable as landfill cap material, and discontinued further sampling efforts. The test pit was backfilled to ground surface with excavated material. The test pit log is provided in Appendix B.

The boring information indicates that the majority of the landfill cover meets, or exceeds, the minimum 2 foot thickness requirement of 35 IAC Part 807. The areas of landfill cover which do not meet the 2 foot requirements are shown in Figure 3. For the purposes of this report, the approximate edge of the unsuitable areas have been defined as the mid-point between applicable borehole locations, adjusted for topography and location. The exact edge of the unsuitable areas will be defined during remedial construction.

The grain size distribution and permeability test results are summarized in Tables 3 and 4, and the laboratory data sheets are compiled in Appendix D. Permeability results are also summarized in Figure 2. These data indicate that the landfill cap is comprised of silty clay (Unified Soil Classification System (USCS) classification CL) with some clayey silt (USCS classification ML), and that the hydraulic conductivity of the sampled cap material range from 8.1×10^{-7} to 2.2×10^{-8} cm/sec. These materials are considered suitable as landfill cover material.

ACTIVITY 3 - ARBOREAL IMPACT ASSESSMENTS

The Arboreal Impact Assessment is intended to determine the distribution and depth of existing tree and woody vegetation root systems on the landfill. However, this assessment has not been performed to date due to scheduling difficulties late in the fall, and we have re-scheduled it to start during the ~~Spring and~~ Summer of 1997.

ACTIVITY 4 - MONITORING WELL ASSESSMENTS

The objective of the Monitoring Well Assessment activity was to confirm the integrity of existing monitoring wells, and to aid in the identification of unnecessary monitoring wells and piezometers. The integrity survey was intended to be completed on monitoring wells

numbered G-100 through G-120, inclusive, and those wells proposed for inclusion in the quarterly groundwater monitoring program. As well, it was intended that each well be redeveloped. However, due to the extraneous nature of some development data (i.e., some wells will be proposed for abandonment) and the excessive amounts of water which would have been generated (i.e., most of the wells had 4 inch diameter casings), the FPD elected to undertake redevelopment only on those wells initially proposed for inclusion in the quarterly groundwater monitoring program. If required, additional monitoring wells may be redeveloped, if they are added to any future detection or compliance groundwater monitoring program.

The integrity survey was conducted from October 23 through October 29, 1996, and included inspections to determine if wells were structurally sound, had adequate protection and were capable of providing representative groundwater quality data. Photographs were taken at each well location, and weep holes were drilled in the well casing, if adequate drainage did not exist. The results of the survey are summarized in Tables 5 and 6, with well development summaries provided in Appendix E. Photographs are filed in Montgomery Watson's project files.

The well integrity survey indicated that the majority of the monitoring wells were structurally intact and secure. The exceptions are noted below:

- Two monitoring wells (G104 and G106) appear to have filter pack sand in the bottom of the wells, indicating possible damage to the well screen or well pipe joint.

- Eight monitoring wells (G100A, G100B, G106, G108, G114A, G119, G121 and G136) have missing or damaged locks, or damaged protective casings with rusted-off or broken lid hinges.

- One monitoring well (G114A) has a cracked and heaved surface seal.

The redevelopment efforts on those wells initially proposed for inclusion in the quarterly groundwater program were generally successful, with indicator parameters stabilizing during redevelopment. Purge water was contained on-site and was later disposed of by the FPD under their leachate disposal permit. However, monitoring well G136 was purged dry after removing approximately one and a half well volumes, with recharge measured at 1 foot recovery in 3 minutes.

The groundwater monitoring network at the landfill was reviewed to identify monitoring wells and piezometers which could be abandoned or retired from future use. Rational for possible abandonment or retirement included; 1) damaged or missing locks, damaged protective casings with rusted-off or broken lid hinges, or insecure surface seals, any of which would require major effort to maintain integrity, 2) screened intervals located within a till aquitard instead of a groundwater aquifer, and 3) wells that are duplicates of nearby wells. A list of the identified wells and piezometers is provided below:

Wells and Piezometers Proposed For Abandonment or Retirement	
Shallow Wells/Piezometers	
P1	Screened within till aquitard outside the edge of the shallow aquifer.
P4	Screened within till aquitard outside the edge of the shallow aquifer.
G100	Screened within till aquitard outside the edge of the shallow aquifer.
G100AB	Missing lock. Duplicate of G100.
G101	Screened within till aquitard outside the edge of the shallow aquifer.
G102	Screened within till aquitard outside the edge of the shallow aquifer.
G103S	Screened within till aquitard outside the edge of the shallow aquifer.
G104	Possible damaged well screen. Screened within till aquitard outside the edge of the shallow aquifer.
G105	Screened within till aquitard outside the edge of the shallow aquifer.
G105ABC	One inch diameter piezometers located in a single borehole. Replaced by G105.
G106	Screened within till aquitard outside the edge of the shallow aquifer. Possible damaged well screen. Missing lock.
G108	Duplicate of G107S and G121. Damaged lock.
G109	Duplicate of G107S and G126.
G110	Duplicate of G126 and G127.
G111	Duplicate of G117 and G127.
G112	Duplicate of G114 and G117.
G113	Duplicate of G114.
G114A	Missing lock. Cracked seal.
G115S	Duplicate of G129.
G116	Water level is not representative of groundwater flow conditions.
G118D	Screened within till aquitard.
G119	Screened within till aquitard outside the edge of the shallow aquifer. Damaged lock.
G124	Screened within till aquitard outside the edge of the shallow aquifer.
G125	Screened within till aquitard outside the edge of the shallow aquifer.
G128S	Duplicate of G117 and G123.
G128I	Duplicate of G128S.
G140S	Duplicate of G127.

Wells and Piezometers Proposed For Abandonment or Retirement	
Deep Wells/Piezometers	
G103D	Screened within till aquitard.
G107D	Screened within till aquitard.
G115D	Screened within till aquitard.
G120S	Screened within till aquitard.
G120D	Screened within till aquitard.
G131DD	Duplicate of G131D.
G132DD	Duplicate of G132D.
G133DD	Duplicate of G133D.
G136	Water level not representative of groundwater conditions. Well was pumped dry during redevelopment activities indicating that the well is apparently screened in crystalline rock with limited fractures. Rusted-off lid on protective casing.

The remaining wells in the groundwater monitoring network were also reviewed to identify ~~those~~existing wells which should be included in the future quarterly groundwater monitoring program as detection monitoring wells, compliance monitoring wells, and water level wells~~.~~, and additional monitoring well requirements. The resulting proposed monitoring program is summarized below.
~~below.~~

~~Wells Proposed For The Quarterly Groundwater Monitoring Program~~	
~~Shallow Wells~~	~~Deep Wells~~
~~G107S, G117, G123, G126, G127, G129~~	~~G128D, G135, G140D, G141D~~
~~Shallow Wells~~	~~Deep Wells~~
~~G122, G133S~~	~~G131D, G133D, G138, G139~~
~~Water Level Wells~~	
~~Shallow Wells~~	~~Deep Wells~~
~~P2, P3, G114, G118S, G121, G130S~~	~~G132D, G134, G137~~

Groundwater Monitoring Network

Detection Monitoring Wells

Glacial Outwash Aquifer Wells	Bedrock Wells
G107S	G128D
G117	G135
G118S	G140D
G123	G141D
G126	**G145** (new well)
G127	
G129	
G130S	

Compliance Monitoring Wells

Glacial Outwash Aquifer Wells	Bedrock Wells
G122	G131D
G133S	G133D
G142 (new well)	G138
G143 (new well)	G139
G144 (new well)	**G146** (new well)

Water Level Wells

Glacial Outwash Aquifer Wells	Bedrock Wells
P2	G132D
G114	G134
G121	G137

Five new monitoring wells will be installed on the west side of the landfill. These supplemental well installations will comprise three shallow monitoring wells (approximately 20 feet deep) and two deep monitoring wells (approximately 60 feet deep).

The three new shallow monitoring wells will be installed adjacent to existing deep well G-138, new deep well G-146, and existing deep well G-139 to form well pairs (see Figures F1 and F2, Appendix F), and will be designated as G-142 through G-144, respectively, to continue the existing numbering system at the landfill. These shallow wells will serve as downgradient compliance wells during the quarterly groundwater monitoring program, and with other exiting wells will provide sufficient representation of the upper outwash aquifer.

The two new deep monitoring wells will be installed in the interval between G-128D and G-135, and adjacent to new shallow well G-143, respectively (see Figures F1 and F2, Appendix F). The new deep well between G-128D and G-135 will become a deep detection monitoring well designated as G-145, while the new deep well adjacent to G-143 will provide compliance coverage of the lower aquifer and will be designated G-146. All

monitoring wells will be installed and developed in accordance with the August 1996 Design Work Plan and Field Sampling Plan for the Predesign Investigation Activities (Vol. III of IV).

Monitoring wells G121 and G136 were initially proposed as a detection or compliance wells for the quarterly groundwater monitoring program. However, the well integrity survey identified that both these wells may have lost integrity due to broken or rusted-off protective casing lids. ~~As well, a review~~In addition, a comparison of data indicated that water levels in well G136 were not representative of groundwater conditions, and the field investigation showed that the well could be pumped dry during development. This suggests that G136 may be screened in crystalline rock with limited fractures. Therefore, wells G107S and G135~~, respectively,~~ are proposed as alternative detection or compliance ~~wells, with G121 still being~~wells and well G121 is proposed as a water level only well.

The well integrity survey and/or well redevelopment has not been performed on ~~9~~seven existing monitoring wells proposed for inclusion in the quarterly groundwater monitoring program ~~(i.e., P2, P3, G130S~~. These are: P2, G132D, G134, and G137 proposed for water levels~~, G107~~; G130S and G135 proposed as detection monitoring wells, and G131D proposed as a compliance monitoring well~~). As well~~. In addition, during previous well re-development efforts, high and potentially inaccurate pH values were measured at well G121, and pH and specific conductivity could not be measured at G127 due to equipment malfunctions. Therefore, we ~~recommend that the well integrity survey be conducted at~~will perform a well integrity survey at the seven wells, P2, G130S, G131D, G132D, G134, G135, and G137, and redevelop seven wells for measurement of indicator parameters: G107S, G118S, G121, G127, G130S, G131D and G135.

~~8 of these wells (i.e., P2, P3, G130S, G131D, G132D, G134, G135 and G137), and that 5 wells be re-developed for measurement of indicator parameters (i.e., G107S, G121, G127, G131D and G135). We recommend these activities be scheduled for May 1997, with~~The well integrity survey will be used to assess the condition of each of these existing well and determine whether each well is suitable as a monitoring point. The integrity survey will be conducted prior to starting the first round of the quarterly monitoring program ~~beginning~~, and will be conducted in accordance with the methods specified in the Field Sampling Plan for Predesign Investigation Activities (Volume III). The survey will include inspections to determine if the wells are structurally sound, provide adequate protection, and are capable of providing representative groundwater quality data, as appropriate. The results of the integrity survey will be ~~immediately thereafter. Proposed d~~summarized in a monitoring well assessment report. If the existing monitoring wells are found to be unsuitable for groundwater sampling, then additional monitoring wells will be proposed or new monitoring wells will be installed. Details of the program are outlined in Appendix F.

ACTIVITY 5 - GAS VENT EVALUATION

The objective of the landfill gas vent evaluation was to evaluate the condition of 30 existing landfill gas vents, and to measure gas quality, if possible. The evaluation consisted of measuring vent depths, leachate head levels and landfill gas composition, and observing the condition of the surface vent/riser. The evaluation was performed on October 21 and 22, 1996.

Gas measurements and monitoring data obtained during the gas vent evaluation are presented in Table 7, while leachate head elevation data for 1996 are presented in Table 8. These tables indicate that liquid depths measured in the vents ranged from 6.52 to 72.80 feet below the top of the vent casing pipe. These values may represent either actual leachate head levels or perched liquids. Landfill gas composition readings were measured at each vent's discharge with a portable gas monitoring instrument. Methane was detected at all but four of the gas vents at concentrations ranging from 1.0 % to 73.5%, by volume. Carbon dioxide levels ranged from zero to 43.0%, by volume, while oxygen concentrations ranged from zero to 20.2%, by volume. Gas pressures ranged from non-measurable to 29.1 inches of mercury. The evaluation also noted that gas vent DV-7 was obstructed at a depth of 87 feet.

The future of the existing gas vents will be discussed, in greater detail, as part of the future O&M plan for the leachate collection system (LCS). The draft O&M Plan is scheduled to be prepared during the construction of the LCS.

3.0 IMPACTS OF REMEDIAL ACTIVITIES

The proposed remedial action for the Blackwell Landfill Site includes repair of the existing landfill cover, installation of a leachate collection system, passive landfill gas venting, and implementation of a monitoring program. These remedial actions are anticipated to have the following impacts on the Site:

Repair of Landfill Cover. The cover repairs will minimize storm water infiltration, and thereby reduce the generation of landfill leachate. The cap repairs will also reduce landfill gas emissions through the cover.

Leachate Collection System. The leachate collection system will remove landfill leachate, and may lower leachate levels in the municipal waste. This may result in an incremental decrease in leachate leakage as the hydraulic gradient is decreased.

Passive Gas Ventilation. The gas ventilation system will reduce gas pressure in the landfill, thereby reducing gas migration, gas emissions, and odors.

Arboreal Impact Evaluation. The arboreal impact evaluation will identify suitable and appropriate species of trees that can safely exist on the landfill.

4.0 SUMMARY AND RECOMMENDATIONS

The predesign investigation activities completed to date have collected suitable information for future design submittals. ~~We recommend scheduling the following remaining investigative activities for Spring and Summer of 1997~~The following activities will be performed during the summer of 1997 pending approval by U.S. EPA:

- ~~Performing the well integrity survey on 8 additional monitoring wells and piezometers, with 5 wells also being redeveloped, and~~

- ~~Re-scheduling the Arboreal Impact Assessment~~ the well integrity survey on seven additional monitoring wells and piezometers;

- Redevelop seven wells;

- Install five new monitoring wells;

- Re-schedule the Arboreal Impact Assessment; and

- Initiate the quarterly monitoring program.

~~We recommend implementing the first round of the groundwater monitoring program as soon as the monitoring plan is approved by the U.S. EPA.. The~~From our review of the existing groundwater monitoring network, we identified an number of wells and piezometers that ~~would~~ill not provide meaningful long-term data or ~~were duplicative~~provide data that is also provided by another monitoring point. Therefore, we recommend abandoning or retiring 36 existing wells and piezometers.

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APPENDIX F
PROPOSED GROUNDWATER MONITORING PLAN

QUARTERLY GROUNDWATER MONITORING

The objective of this activity is to detect changes in the chemical concentration of the groundwater in both the glacial aquifer and in the underlying bedrock aquifer in downgradient areas between the landfill and the Blackwell Forest Preserve's boundary during the period between remedial design and Record of Decision. Instructions for the collection of samples are located in Appendix A of the Field Sampling Plan for Pre-Design Investigation Activities, August 1996 (Vol. III of IV), and the attached Addendum (Groundwater Sampling and Testing SOP).

Description of Response Action

The groundwater monitoring program for the site will consist of the following tasks:

Task	Schedule for Implementation
1. ~~Implement quarterly monitoring~~ Installation of Monitoring Wells	Upon approval of this Proposed Monitoring Plan
2. Implement quarterly monitoring	Upon approval of this Proposed Monitoring Plan
~~2.~~ 3. Recommend modifications to the monitoring program	~~Within the 30% Design Submittal~~Upon evaluation of quarterly data
~~3~~4. Implement O & M monitoring program	Upon receipt of the Record of Decision and Consent Decree or Unilateral Administrative Order

The tasks incorporate the requirements of the U.S. EPA's Scope of Work. The following sections provide the design and implementation plans for the quarterly monitoring program required in the U.S. EPA's Scope of Work. Upon approval of this Proposed Monitoring Plan, the quarterly monitoring program will be implemented. Changes to the monitoring program may be recommended ~~in the 30% design submittal. These changes will~~following evaluation of the quarterly data and any changes would be implemented as part of the long term O&M and monitoring program.

Purpose

The monitoring program will include field and laboratory testing of samples. Analytical results will be used to:

- Provide on-going characterization of groundwater quality downgradient of the site.

- Provide baseline groundwater data during the cap repair remediation, which may be utilized to estimate the length of time until groundwater standards are met through natural attenuation.

- Determine whether the reduction of contaminant loading from the cap repairs, in combination with natural attenuation and dilution, will allow for the standards of 35 IAC 620.410 to be achieved over time.

- To confirm that concentrations of groundwater contaminants do not exceed any MCL, an excess cancer risk greater than 10^{-6}, or Hazard Index greater than or equal to 1.0, whichever is more stringent, at the Blackwell Forest Preserve's downgradient boundary.

~~**New Wells**~~

~~No new wells are proposed at this time. Additional monitoring well installations may be recommended as a modification to the monitoring program within the 30% Design Report, if any data gaps are identified during the first round of quarterly monitoring.~~

Five monitoring wells will be installed on the west side of the Blackwell Landfill.

Wells to be Installed	Aquifer	Well Service Designation
G142	Outwash Glacial	Compliance
G143	Outwash Glacial	Compliance
G144	Outwash Glacial	Compliance
G145	Bedrock	Detection
G146	Bedrock	Compliance

These monitoring well installations will supplement the sampling of the glacial aquifer and the underlying bedrock during quarterly groundwater monitoring program.

Monitoring Program

~~E~~New and existing monitoring wells have been selected for the groundwater monitoring program for the site. The wells are divided into: 1) detection monitoring wells located between the landfill and the Blackwell Forest Preserve's boundary; 2) compliance monitoring wells located along the downgradient boundary of the Preserve, and 3) other monitoring wells or piezometers for water level measurements only. The monitoring program is further divided into wells which monitor the glacial outwash aquifer (Figure F1) and those which monitor the underlying bedrock aquifer (Figure F2). The definition of detection and compliance monitoring, and the rationale for the choice of monitoring wells, is described below:

Detection Monitoring Wells

Glacial Outwash Aquifer Wells	Bedrock Wells
G107S	G128D
G117	G135
~~G123~~	~~G140D~~
~~G126~~	~~G141D~~
~~G127~~	
~~G129~~18S	G140D
G123	G141D
G126	**G145***
G127	
G129	
G130S	

Compliance Monitoring Wells

Glacial Outwash Aquifer Wells	Bedrock Wells
G122	~~G131D~~
~~G133S~~	~~G133D~~
	~~G138~~
	~~G139~~G131D G133S
G133D	
G142*	G138
G143*	G139
G144*	**G146***

Water Level Wells

Glacial Outwash Aquifer Wells	Bedrock Wells
P2	
~~P3~~	~~G132~~
~~G114~~	~~G134~~
~~G118S~~	~~G137~~
~~G121~~	
~~G130S~~G132	
G114	G134
G121	G137

Note:
* Monitoring wells to be installed and added to the quarterly groundwater monitoring plan.

The detection monitoring wells listed above were chosen to monitor downgradient groundwater quality concentrations between the landfill waste boundary and the FPD property boundary. These wells were chosen as detection monitoring wells, because they are in the ~~bes~~correct locations, downgradient of the landfill, to assess any changes in groundwater quality relative to existing concentrations.

The compliance monitoring wells were chosen, because they are located closest to the FPD property boundary, downgradient of the landfill. These wells will be used to confirm that concentrations of groundwater contaminants in these boundary wells do not exceed any MCL, cancer risk greater than 10^{-6}, or Hazard Index greater than or equal to 1.0, whichever is more stringent.

The water level monitoring wells were chosen to provide additional water level data from that collected from the detection and compliance monitoring wells. As a network, these wells can be used to establish groundwater flow direction and velocity at the time of quarterly monitoring.

It is anticipated that one or more upgradient wells may be added to the monitoring program following assessment of the first round of quarterly monitoring. ~~Any additions to the groundwater monitoring program will be proposed in the 30% design report.~~

Quality Control Sampling

Quality control samples will be collected, and will consist of sample duplicates, field blanks, and matrix spike/matrix spike duplicates (MS/MSD) samples, as described below.

Field Blanks (FB)
A laboratory prepared sample of reagent grade water will be routed through decontaminated sampling equipment to assess the effectiveness of decontamination procedures.

For Level IV water samples, one field blank will be prepared for each container type and size. Field blanks will be prepared according to the following schedule for each sampling activity:

- One field blank for every 10 or fewer samples of water collected; and
- For each sample period, a minimum of one blank for each group of parameters per sample matrix.

The field blank samples will be prepared using deionized water stored in polyethylene containers. For monitoring well samples, the water will be routed through the previously decontaminated sampling device before transfer to the container.

Trip Blanks (TB)
A water sample, prepared by the laboratory, will be transported to the site. The sample will remain unopened and be returned to the laboratory for analysis to evaluate QA/QC of sample handling procedures.

A trip blank for VOC analyses will be included in each sample cooler containing water matrix samples intended for VOC analysis. The trip blanks will consist of two 40-ml VOA vials filled with deionized water with a Milli-Q cleanup. It will be prepared in the office or laboratory, transported to the field and shipped with the other samples to the designated laboratory without being opened. It will be packaged using standard procedures as for other sample bottles.

Matrix Spike and Matrix Spike Duplicates (MS/MSD)
An additional sample volume collected in the field and sent to the laboratory for analysis. The results are used to evaluate the effect of the sample matrix on the digestion and measurement methodology. For water samples, one sample per group of 20 or fewer samples collected for VOC and SVOC analysis during each sampling activity will be selected for matrix spike/matrix spike duplicate (MS/MSD) analysis. For SVOCs, double the normal sample volume will be collected (i.e., four~~, 1 L~~ one-liter bottles). For VOCs, triple the normal sample volume will be collected (i.e., six, 40 ml vials).

Sample Duplicates
A duplicate sample taken in the field and analyzed in the laboratory to evaluate the homogeneity of the sample medium and the precision of the laboratory. One duplicate sample will be collected for each increment of 10 or fewer samples collected for each matrix during each sampling period. A duplicate sample will consist of a sample obtained from the same sampling device as the original sample.

A summary of the investigative and QA/QC samples is presented in Table 1-1. of the QAPP for Pre-design Investigation Activities (Vol. IV or IV) (August 1996). The supplier of the contaminant free sample containers will be the I-Chem Company or equivalent. The containers will be CLP Level 300 series bottles or equivalent.

Sampling Method

Low flow sampling procedures will be used to obtain all groundwater samples. This sampling technique is described in the attached SOP (Addendum to the QAPP for the Pre-Design Investigation Activities, August 1996).

Groundwater Sampling Frequency

The groundwater monitoring program will consist of performance of field and laboratory testing of the samples collected from each of the wells listed above. The monitoring program will begin following approval of this monitoring program. Sampling will be performed on a quarterly basis. Additional parameters will be included on an annual frequency. Table 1-1 of the QAPP for Pre-Design Investigation Activities (August 1996) (Volume IV) provides a listing of the parameters and frequency of sampling.

The U.S. EPA SOW indicates that if quarterly groundwater monitoring over a period of eight quarters indicates that contaminant concentrations throughout the system of groundwater monitoring wells are not increasing, the FPD may petition the U.S. EPA to allow monitoring on a less frequent basis. The U.S. EPA Statement of Work also states that if additional information indicates that the groundwater monitoring program is inadequate, the U.S. EPA may require that additional groundwater monitoring wells be added to the program.

Sample Analysis

Groundwater samples collected will be analyzed in the field and the analytical laboratory, as appropriate, for the parameters specified in Table 1-1 of the QAPP for Pre-Design Investigation Activities (August 1996). Groundwater samples will be analyzed for volatile organic compounds on the Target Compound List (TCL), semi-volatile organic compounds on the TCL, and the full Target Analyte List (TAL) of metals. Indicator parameters include chloride, sulfate, and TDS. Field parameters to be measured and recorded for each monitoring well are groundwater elevation, pH, temperature, turbidity, specific conductance, redox potential, and dissolved oxygen.

Analyses will be in compliance with, and meet the reporting limits required by, the State of Illinois' Groundwater Quality Standards at 35 IAC 620, and any Maximum Contaminant Level (MCL) designated at 40 CFR Part.

If additional information indicates that the groundwater monitoring program is inadequate, the U.S. EPA may require additional field or laboratory analysis of additional parameters.

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